Listing of Claims

Please amend the claims as follows:

1. (Previously Presented): A distributed Bragg reflector, comprising:

a first semiconductor layer having a first refractive index;

a second semiconductor layer having a second refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately; and

a material layer, provided between said first semiconductor layer and said second semiconductor layer, having a thickness equal to or larger than 5 nm but equal to or smaller than 50 nm such that a reflective change rate is substantially uniform as a compositional gradation layer thickness increases, and having a third refractive index intermediate between said first and second refractive indices,

wherein said distributed Bragg reflector is tuned to a wavelength of 1.1 μm or longer.

2. (Original): A distributed Bragg reflector as claimed in claim 1, wherein said material layer has a thickness equal to or larger than 20 nm.

3. (Original): A distributed Bragg reflector as claimed in claim 1, wherein said material layer has a thickness equal to or larger than 30 nm.

4. (Original): A distributed Bragg reflector as claimed in claim 2, wherein said first and second semiconductor layers are formed of any of AlAs, GaAs and AlGaAs, and wherein

there is a difference of Al content of less than 80% between said first semiconductor layer and said second semiconductor layer.

5. (Original): A distributed Bragg reflector as claimed in claim 3, wherein said first semiconductor layer and said second semiconductor layer are formed of any of AlAs, GaAs and AlGaAs, and wherein there is a difference of Al content of 80% or more between said first semiconductor layer and said second semiconductor layer.

6. (Currently Amended): A distributed Bragg reflector, comprising:

a first semiconductor layer having a first refractive index;

a second semiconductor layer having a second refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately; and

a material layer having a third refractive index intermediate between said first and second refractive indices, said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer,

said material layer having a thickness equal to or smaller than (~~50λ~~ 0.005λ-15) (nm) where λ is a tuned wavelength (nm) of the distributed Bragg reflector, such that a reflective change rate is substantially uniform as a ~~compositional uniform as a~~ compositional gradation layer thickness increases.

7. (Original): A distributed Bragg reflector as claimed in claim 6, wherein said material layer has a thickness of 20 nm or more.

8. (Original): A distributed Bragg reflector as claimed in claim 6, wherein said material layer has a thickness of 30 nm or more.

9. – 17. (Canceled).

18. (Previously Presented): A surface-emission laser diode, comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first refractive index;

a second semiconductor layer having a second refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately; and

a material layer having a third refractive index intermediate between said first and second refractive indices, said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer,

said material layer having a thickness equal to or larger than 5 nm but equal to or smaller than 50 nm such that a reflective change rate is substantially uniform as a compositional gradation layer thickness increases.

19. (Original): A surface-emission laser diode as claimed in claim 18, wherein said material layer has a thickness equal to or larger than 20 nm.

20. (Original): A surface-emission laser diode as claimed in claim 18, wherein said material layer has a thickness equal to or larger than 30 nm.

21. (Original): A surface-emission laser diode as claimed in claim 19, wherein said first and second semiconductor layers are formed of any of AlAs, GaAs and AlGaAs, and wherein there is a difference of Al content of less than 80% between said first semiconductor layer and said second semiconductor layer.

22. (Original): A surface-emission laser diode as claimed in claim 20, wherein said first semiconductor layer and said second semiconductor layer are formed of any of AlAs, GaAs and AlGaAs, and wherein there is a difference of Al content of 80% or more between said first semiconductor layer and said second semiconductor layer.

23. (Original): A surface-emission laser diode as claimed in claim 18, wherein said active layer is formed of any of a GaNAs layer, a GaInAs layer, a GaInNAs layer, a GaAsSb layer, a GaInAsSb layer, and a GaInNAsSb layer.

24. (Currently Amended) A surface-emission laser diode, comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer,

at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first refractive index;

a second semiconductor layer having a second refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately; and

a material layer having a third refractive index intermediate between said first and second refractive indices, said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer,

said material layer having a thickness smaller than or equal to (~~50λ~~0.05λ-15) (nm) where λ is a tuned wavelength (nm) of the distributed Bragg reflector, such that a reflective change rate is substantially uniform as a ~~compositional uniform as a~~ compositional gradation layer thickness increases.

25. (Original) A surface-emission laser diode as claimed in claim 24, wherein said material layer has a thickness of 20 nm or more.

26. (Original) A surface-emission laser diode as claimed in claim 24, wherein said material layer has a thickness of 30 nm or more.

27. (Original) A surface-emission laser diode as claimed in claim 24, wherein said active layer is formed of any of a GaNAs layer, a GaInAs layer, a GaInNAs layer, a GaAsSb layer, a GaInAsSb layer, and a GaInNAsSb layer.

28. – 36. (Canceled).

37. (Previously Presented): A laser diode array, comprising:

a substrate; and

a plurality of surface-emission laser diodes formed commonly on said substrate, each of said plurality of surface-emission laser diodes comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer,

at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first refractive index;

a second semiconductor layer having a second refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately; and

a material layer having a third refractive index intermediate between said first and second refractive indices, said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer,

said material layer having a thickness equal to or larger than 5 nm but equal to or smaller than 50 nm such that a reflective change rate is substantially uniform as a compositional gradation layer thickness increases.

38. (Currently Amended) A laser diode array, comprising:

a substrate; and

a plurality of surface-emission laser diodes formed commonly on said substrate, each of said surface emission laser diodes comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first refractive index;

a second semiconductor layer having a second refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately; and

a material layer having a third refractive index intermediate between said first and second refractive indices, said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer, and

said material layer having a thickness smaller than or equal to (~~50~~λ0.05λ-15) (nm) where λ is a tuned wavelength (nm) of the distributed Bragg reflector, such that a reflective change rate is substantially uniform as a ~~compositional uniform as a~~ compositional gradation layer thickness increases.

39. (Canceled).

40. (Previously Presented): An optical interconnection system, comprising:

a surface-emission laser diode; and

an optical transmission path coupled optically to said surface-emission laser diode, said surface-emission laser diode comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first refractive index;

a second semiconductor layer having a second refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately; and

a material layer having a third refractive index intermediate between said first and second refractive indices,

said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer, and

said material layer having a thickness equal to or larger than 5 nm but equal to or smaller than 50 nm such that a reflective change rate is substantially uniform as a compositional gradation layer thickness increases.

41. (Currently Amended) An optical interconnection system, comprising:

a surface-emission laser diode; and

an optical transmission path coupled optically to said surface-emission laser diode, said surface-emission laser diode comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first refractive index;

a second semiconductor layer having a second refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately; and

a material layer having a third refractive index intermediate between said first and second refractive indices, said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer, and

said material layer having a thickness smaller than or equal to (~~50λ~~0.05λ-15) (nm) where λ is a tuned wavelength (nm) of the distributed Bragg reflector, such that a reflective change rate is substantially uniform as a ~~compositional uniform as a~~ compositional gradation layer thickness increases.

42. (Canceled).

43. (Previously Presented): An optical interconnection system, comprising:

a surface-emission laser diode array comprising a substrate and a plurality of surface-emission laser diodes provided commonly on said substrate; and

an optical transmission path coupled optically to each of said plurality of surface-emission laser diodes, each of said plurality of surface-emission laser diodes comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first refractive index;

a second semiconductor layer having a second refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately; and

a material layer having a third refractive index intermediate between said first and second refractive indices,

said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer, and

said material layer having a thickness equal to or larger than 5 nm but equal to or smaller than 50 nm such that a reflective change rate is substantially uniform as a compositional gradation layer thickness increases.

44. (Currently Amended) An optical interconnection system, comprising:

a surface-emission laser diode array comprising a substrate and a plurality of surface-emission laser diodes formed commonly on said substrate; and

an optical transmission path coupled optically to each of said plurality of surface-emission laser diodes, each of said surface-emission laser diodes comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first refractive index;

a second semiconductor layer having a second refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately; and

a material layer having a third refractive index intermediate between said first and second refractive indices,

said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer, and

said material layer having a thickness smaller than or equal to (~~50λ~~0.05λ-15) (nm) where λ is a tuned wavelength (nm) of the distributed Bragg reflector, such that a reflective change rate is substantially uniform as a ~~compositional uniform as a~~ compositional gradation layer thickness increases.

45. (Canceled)

46. (Previously Presented): An optical telecommunication system, comprising:

a surface-emission laser diode; and

an optical transmission path coupled optically to said surface-emission laser diode,

said surface-emission laser diode comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first refractive index;

a second semiconductor layer having a second refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately; and

a material layer having a third refractive index intermediate between said first and second refractive indices,

said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer, and

said material layer having a thickness equal to or larger than 5 nm but equal to or smaller than 50 nm such that a reflective change rate is substantially uniform as a compositional gradation layer thickness increases.

47. (Currently Amended) An optical telecommunication system, comprising:

a surface-emission laser diode; and

an optical transmission path coupled optically to said surface-emission laser diode, said surface-emission laser diode comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first refractive index;

a second semiconductor layer having a second refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately; and

a material layer having a third refractive index intermediate between said first and second refractive indices,

said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer, and

said material layer having a thickness smaller than or equal to ($\cancel{50}\lambda$0.05λ-15) (nm) where λ is a tuned wavelength (nm) of the distributed Bragg reflector, such that a reflective change rate is substantially uniform as a ~~compositional uniform as a~~ compositional gradation layer thickness increases.

48. (Canceled).

49. (Previously Presented) An optical telecommunication system, comprising:

a surface-emission laser diode array comprising a substrate and a plurality of surface-emission laser diodes provided commonly on said substrate; and

an optical transmission path coupled optically to each of said plurality of surface-emission laser diodes, each of said plurality of surface-emission laser diodes comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first refractive index;

a second semiconductor layer having a second refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately; and

a material layer having a third refractive index intermediate between said first and second refractive indices,

said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer, and

said material layer having a thickness equal to or larger than 5 nm but equal to or smaller than 50 nm such that a reflective change rate is substantially uniform as a compositional gradation layer thickness increases.

50. (Currently Amended) An optical telecommunication system, comprising:

a surface-emission laser diode array comprising a substrate and a plurality of surface-emission laser diodes provided commonly on said substrate; and

an optical transmission path coupled optically to each of said plurality of surface-emission laser diodes, each of said plurality of surface-emission laser diodes comprising:

an active layer; and

a resonator cooperating with said active layer, said active layer comprising upper and lower reflectors disposed above and below said active layer, at least one of said upper and lower reflectors comprising a distributed Bragg reflector, comprising:

a first semiconductor layer having a first refractive index;

a second semiconductor layer having a second refractive index, said first refractive index larger than said second refractive index, said first and second semiconductor layers being stacked alternately; and

a material layer having a third refractive index intermediate between said first and second refractive indices,

said distributed Bragg reflector being tuned to a wavelength of 1.1 μm or longer, and

said material layer having a thickness smaller than or equal to ~~(50λ-15)~~ (0.005λ-15) (nm) where λ is a tune wavelength (nm) of the distributed Bragg

reflector, such that a reflective change rate is substantially uniform as a ~~compositional uniform as a~~ compositional gradation layer thickness increases.

51. – 62. (Canceled).